A "CASE" Study on Developing Science Communication and Outreach Skills of University Graduate Student Researchers in Alaska

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CASE: Changing Alaska Science Education
A GK-12 Project at UAF

Introduction

Well rounded scientific researchers are not only experts in their field, but can also communicate their work to a multitude of various audiences, including the general public and undergraduate university students. Training in these areas should ideally start during graduate school, but many programs are not preparing students to effectively communicate their work. Here, we present results from the NSF-funded CASE (Changing Alaska Science Education) program, which was funded by NSF under the auspices of the GK-12 program. CASE placed science graduate students (fellows) in K-12 classrooms to teach alongside of K-12 teachers with the goal of enhancing communication and teaching skills among graduate students. CASE trained fellows in inquiry-based and experiential techniques and emphasized the integration of art, writing, and traditional Alaska Native knowledge in the classroom. Such techniques are especially effective in engaging students from groups that are underrepresented in science.

Third grade students from Hunter Elementary, along with their primary teacher, partnered with a UAF graduate student through the CASE GK-12 program to learn science during the 2014 - 2015 academic year. Here they survey a vegetation transect and learn about plant taxonomy in the boreal forest of Fairbanks, Alaska in September 2014.

Experiential Science Teaching and Learning

During the five years of the NSF funded CASE GK-12 program in Alaska, forty one graduate students from the University of Alaska Fairbanks (UAF) were chosen as teaching fellows. These graduate students received both training and in-classroom experience on designing and implementing hands-on, inquiry based science lessons for K-12 students in Fairbanks, Alaska.

Methods

In order to assess whether the project met its goals with respect to graduate fellows, we developed a survey that measured changes in fellows' attitudes about their skills. All fellows over the five year period were surveyed, and 39 matched pre and post surveys were completed. We developed four scales: 1) communicating science to various audiences through a variety of methods (***Communication Skills***); 2) knowledge of pedagogical techniques and application of these techniques to a variety of audiences (***Inquiry Teaching Skills***); 3) awareness of teaching challenges for K-12 educators (***Understanding of K-12 Education***); and 4) addressing cultural differences (***Cultural Differences***). Cronbach's alpha was above 0.7 for all scales, indicating that they were reliable (acceptable reliability values can range from 0.7-0.95 depending on context; Nunnaly 1987).

We calculated scale scores for each respondent. The scale score is the average of the response to items included in each scale, with 1.0 being low and 4.0 being high. We used a ***paired samples t-test*** to see whether the pre- and post-mean scale scores were significantly different.

Results

The mean pre- to post-scale scores increased significantly for all skill scales (Table 1). The greatest gains were in the fellows' understanding of K-12 education and cultural differences during Project Years 1 and 2 (note: data is missing for Project Years 3 and 4 for cultural differences, as the questions were changed at the end of Year 3).

Table 1. Changes in CASE fellow's attitudes about their skills from pre to post survey. *p< 0.01; **p<0.001

Scale	Pre Mean	Post Mean	Change	S.D.	t-value	df
Communication Skills	3.28	3.69	0.41**	0.48	5.37	38
Understanding K-12 Education	2.58	3.50	0.91**	0.55	10.16	37
Inquiry Skills and Activities	3.04	3.61	0.56**	0.52	6.61	36
Cultural Differences (PY1-PY2)	2.56	3.35	0.79**	0.50	7.33	20
Cultural Differences (PY5)	2.47	3.50	1.03*	0.54	5.43	7

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Conclusions

As a result of participation, many CASE fellows have reported increased skills in communication, teaching, and in time management. These skills may prove directly applicable to higher education when teaching undergraduate students. Teaching Alaska Native K-12 students can give graduate students, who will go on to teach university courses as professors, a better perspective on communicating across different cultural contexts. This may result in more effective communication strategies when teaching collegiate level science to diverse groups of students.

Third grade students build a groundwater model in a box to learn about hydrology and soil science.

Future Implications

A number of former CASE GK-12 fellows at UAF are currently working on a Graduate Certificate in Science Teaching and Outreach, which developed in part as a legacy activity of CASE. These certificates give graduate students training that is directly applicable to teaching and service activities that are part of faculty positions. We anticipate that development of these additional skills may give graduating students an edge when seeking employment at universities, or in science research positions that may involve community outreach. Both CASE and the certificate program offer concrete experience with "broader impact" activities that are required as part of some federal grants.

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